THE WEATHER AND CIRCULATION OF OCTOBER 1952 [1]

The Driest Month on Record in the United States

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THE DROUGHT

Over the United States as a whole October 1952 set a new record by a wide margin as the driest month ever observed. This month's average rainfall for the nation was 0.54 inches, only 26 percent of normal, and the least precipitation on both an absolute and relative scale for all months in the long Weather Bureau record dating from 1886. Figure 1 and Charts II and III reveal the details of the October drought over the United States. Along and west of the Mississippi Valley many States had precipitation averaging less than 10 percent of normal. In fact, a large portion of this region, comprising one-third or more of the total area of the United States, went without any measurable rainfall during the entire month. At Salt Lake City, Utah, this was the first October in 79 years of record without any precipitation and 62 consecutive rainless days passed before precipitation finally fell in that city on November 13. Minneapolis-St. Paul, Minn., with total October rainfall of only 0.01 inch, had the driest October since 1857. Louisiana and Mississippi suffered the second longest rainless period on record (45 days) ending on November 6. Similar records were set at many other stations in this area. East of the Mississippi, although precipitation was generally not so deficient as in the West, most States reported less than 50 percent of their normal October rainfall. Florida was the only State in the nation where October rainfall was in excess of the normal amount.

The drought over most of the Nation became very pronounced in late September [1] and continued through the first week of November. However, in many areas of the Midwest and South this period was the culmination of a much longer period of generally deficient precipitation extending as far back as the spring of 1952 [2, 3]. A tabulation of precipitation amounts and their departures from normal at a selected group of stations (table 1) shows the extent of the cumulative deficiency of precipitation in the 3- and 5-month periods ending in early November.

[1] See Charts I–XV following p. 202 for analyzed climatological data for the month.

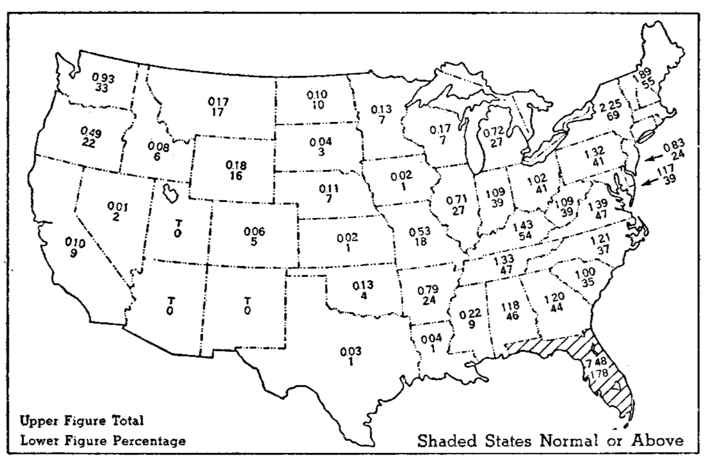


FIGURE 1.—Total inches and percentage of normal precipitation by States, October 1952. (From U. S. Weather Bureau, *Weekly Weather and Crop Bulletin National Summary* for week ending November 18, 1952.)

TABLE 1.—*Total precipitation and departures from normal (inches) during extended drought period* [1]

Station	12 weeks ending Nov. 4, 1952		22 weeks ending Nov. 4, 1952	
	Total	Departure	Total	Departure
Arkansas				
Fort Smith	3.52	−4.93	7.49	−8.52
Little Rock	3.14	−5.48	8.39	−8.39
Indiana				
Evansville	3.79	−5.95	11.32	−4.40
Kansas				
Concordia	1.77	−4.71	4.77	−10.68
Dodge City	2.25	−2.51	3.96	−8.20
Goodland	1.46	−3.11	5.73	−5.29
Wichita	2.07	−5.70	8.45	−7.96
Kentucky				
Louisville	4.84	−3.60	11.54	−5.23
Louisiana				
Shreveport	.95	−6.60	6.95	−8.37
Mississippi				
Vicksburg	2.32	−5.69	4.47	−13.06
Meridian	1.41	−5.60	6.18	−12.96
Nebraska				
Lincoln	2.94	−4.17	15.37	−0.96
North Platte	1.88	−1.94	6.66	−3.79
Valentine	.39	−3.25	4.75	−5.65
Oklahoma				
Oklahoma City	.82	−6.91	5.89	−9.24
Texas				
Abilene	2.34	−4.56	3.10	−9.39
Amarillo	.84	−4.96	3.87	−8.73
Austin	2.32	−5.81	4.89	−7.90
Big Spring	2.66	−3.58	3.37	−7.41
Del Rio	.02	−6.19	.66	−10.87
Fort Worth	.55	−6.76	1.55	−12.38
Laredo	.53	−6.15	5.15	−5.37

[1] From *Weekly Weather and Crop Bulletin, National Summary* for week ending Nov. 4, 1952.

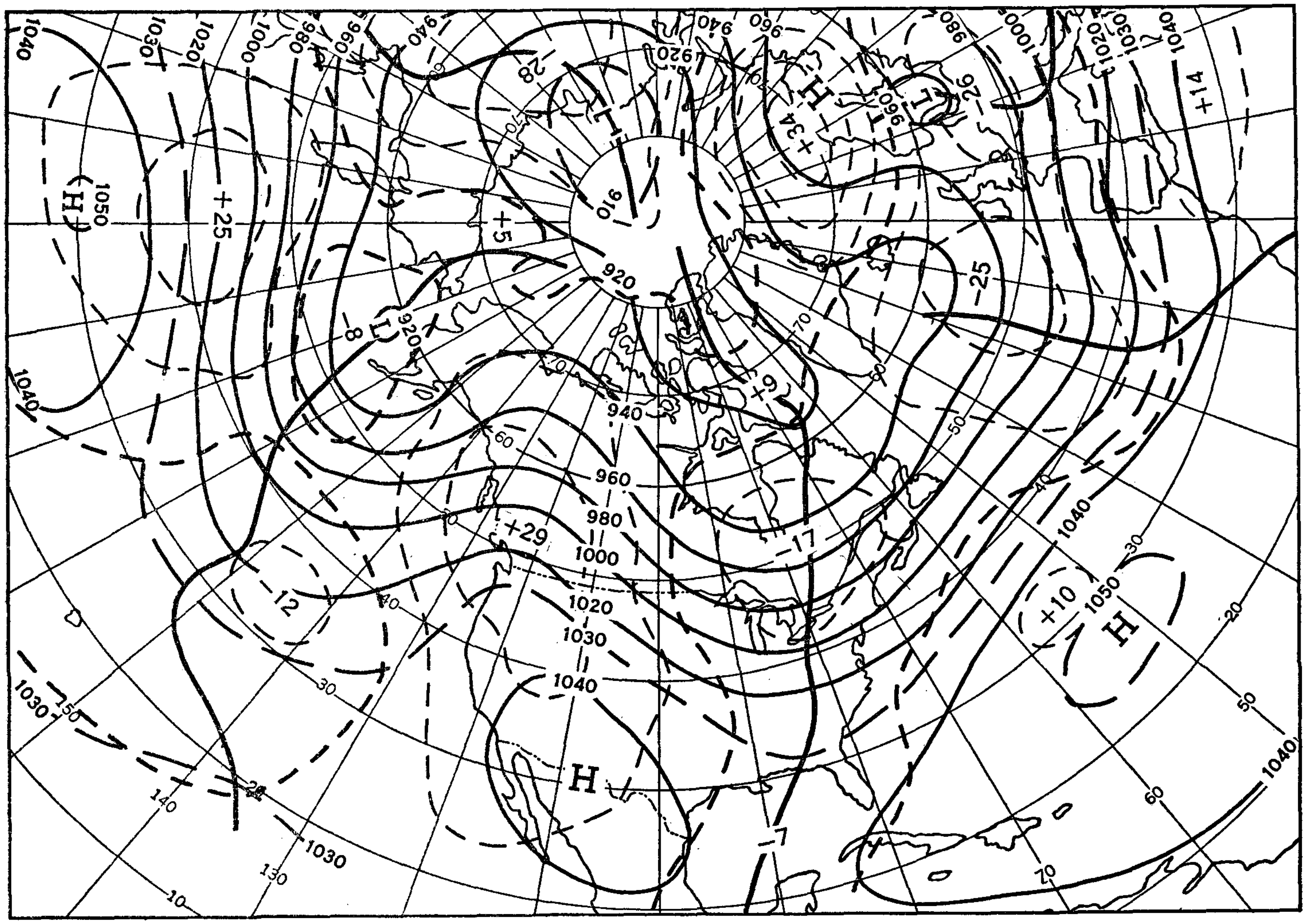


FIGURE 2.—Mean 700-mb. chart for the 30-day period September 30–October 29, 1952. Height anomalies at 100-foot intervals are shown by short dashed lines and anomaly centers are labeled in tens of feet. Minimum latitude trough locations are shown by heavy solid lines.

There were several serious consequences of this extensive and severe autumn drought as it persisted into late October. Forest, grass, and brush fires were reported in more than half of the States east of the Rocky Mountains. Thousands of square miles of grass and timber lands were scorched as many of these fires became uncontrolled. Shenandoah National Park in Virginia as well as many State and National forests were closed to the public as the fire hazard became extremely critical late in the month. Heavy smoke palls resulted from these extensive fires and lingered over many central and eastern sections of the country both night and day during periods of pronounced vertical atmospheric stability in the second half of October. Smog from Louisiana prairie fires lowered the visibility so much that traffic was disrupted in New Orleans on the 27th. Water shortages developed in many central sections of the nation as wells, ponds, and streams began to dry up. Planting and germination of the winter wheat crop were seriously retarded by the drought, and prospects for the crop were very poor at month's end.

RELATED CIRCULATION FEATURES

The middle and upper tropospheric circulation over North America and vicinity was dominated by a sinusoidal wave pattern of large amplitude consisting of an abnormally strong ridge over the mountains of western North America flanked by two pronounced troughs, one over the eastern Pacific, the other over eastern North America (fig. 2 and Charts XIII–XV). This is the same basic pattern which first became established during the second half of September [1], and prevailed with very little variation from day to day or week to week throughout October. The western ridge was the most prominent feature of this pattern since mean 700-mb. heights were more than 200 feet above normal over a broad region extending from the Yukon to southern Utah. Heights over British Columbia, where a maximum anomaly of

+290 feet was located, were higher than any observed over that area in the entire 20-year period comprising our file of monthly mean maps for October. High pressure also existed in this area at sea level, where pressures were as much as 6 mb. above normal (Chart XI).

The explanation for the generally dry weather over the United States is relatively simple in terms of these large-scale circulation features. Abnormally strong components of northerly flow (as indicated by the close spacing and north-south orientation of anomaly lines in fig. 2) between the trough over the East and the ridge over the West brought persistently recurrent outbreaks of dry Canadian polar air far southward into the central United States. Stronger-than-normal westerly flow and very weak southerly components through the eastern trough north of Georgia allowed this cold dry Canadian air to flow rapidly to the East Coast and minimized the opportunity for northward transport of moist tropical air. The only region of the country where a pronounced influx of moist air was well indicated by the monthly mean circulation was Florida, which was located to the northeast of a negative height anomaly center in the trough over the Gulf of Mexico. As stated earlier, Florida was the only State with more rainfall than normal during October. Dry weather west of the Continental Divide was associated with subsidence in the abnormally strong western ridge. The west coast of the United States was kept dry by the prevailing offshore flow with respect to normal at 700-mb. and also at sea level (Chart XI). The mean sea level circulation in other parts of the country was also clearly associated with subnormal precipitation since pressures were generally above normal over the Nation in and around an extended ridge stretching from British Columbia southeastward to the Appalachians.

Also related to the circulation and the drought were the prevailing tracks of cyclones and anticyclones during the month. Chart X illustrates very clearly the nearly complete lack of cyclonic activity in the United States and the great concentration of cyclones in Canada. On the other hand, Chart IX shows a maximum density of anticyclone tracks across the United States and a minimum of anticyclones in eastern Canada. These conditions were related to the mean sea level ridge over the United States and the east-west sea level trough across Canada (Chart XI). In terms of the 700-mb. circulation most anticyclones traveled south of the mean jet stream where anticyclonic relative vorticity prevailed across the United States, while cyclones were mainly concentrated north of the jet in Canada where pronounced cyclonic vorticity existed (figs. 3 and 4). The east-west maximum of anticyclonic vorticity which extended through middle sections of the eastern United States provides another ready explanation for the subnormal precipitation observed over the East despite the presence of the trough just west of the Appalachians. Figure 4 also helps explain the heavy precipitation in Florida where a channel of cyclonic vorticity extended eastward across Florida from a center in the Gulf of Mexico. Storms which developed near Florida and the Bahamas traveled from this region of cyclonic vorticity northeastward through a distinct minimum of anticyclonic vorticity reaching the main belt of westerlies in mid-Atlantic (Chart X and figs. 3 and 4).

To a great extent these relationships between the circulation pattern of October 1952 and the generally dry weather over the United States tie in closely with empirical findings for previous cold season regimes. Tannehill [4] pointed out that November droughts over the nation are generally associated with high surface pressure in the

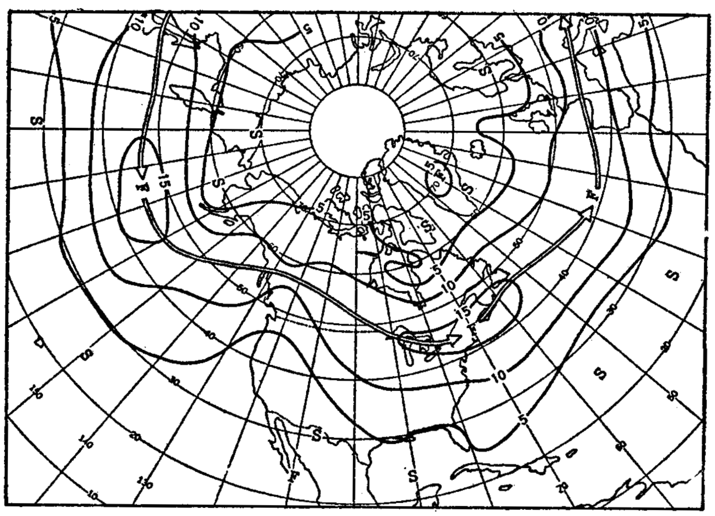


FIGURE 3.—Mean horizontal geostropic wind speed at 700-mb. for the 30-day period September 30–October 29, 1952, in m sec^{-1}. Arrowed line indicates the major axis of maximum wind speeds (jet). Centers of maximum and minimum wind speed are labeled "F" and "S" respectively.

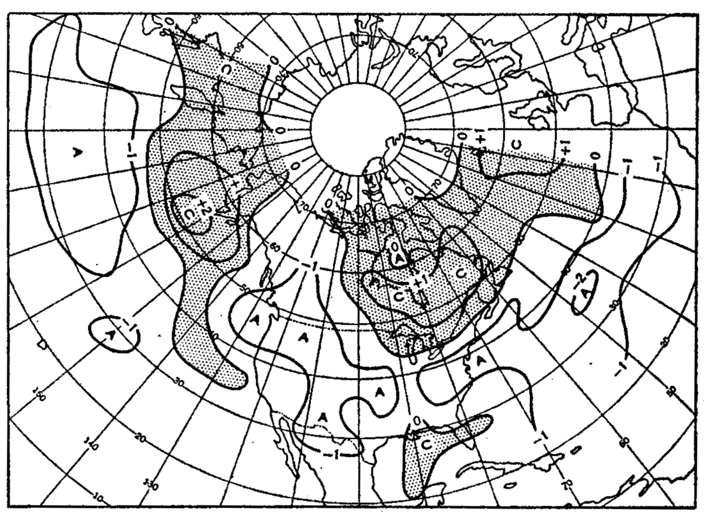


FIGURE 4.—Mean relative geostropic vorticity at 700-mb. for the 30-day period September 30–October 29, 1952 in units of 10^{-5} sec^{-1}. Areas of cyclonic vorticity are shaded and labeled "C" at centers of maximum vorticity. Areas of maximum anticyclonic vorticity are labeled "A".

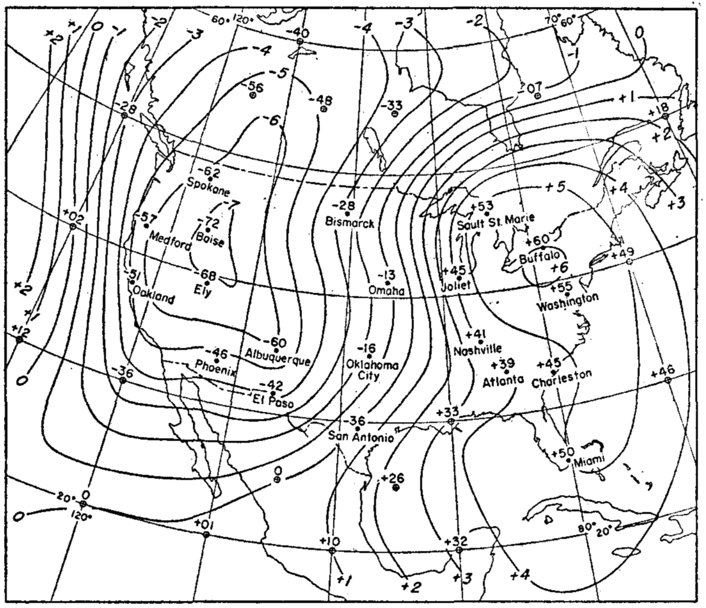


Figure 5.—Correlation field patterns of mean monthly 700-mb. height anomalies at indicated locations vs. monthly rainfall averaged over the United States as a whole for winter months from 1939 to 1952. Correlation coefficients are shown in hundredths and correlation isopleths are labeled in tenths (decimal points omitted). (*After Stidd.*)

Great Basin region. Recent work by C. K. Stidd has clearly demonstrated that subnormal monthly precipitation in the United States as a whole during the cold season is closely related to positive monthly mean 700-mb. height anomalies in the West, as well as negative height anomalies in the East. Figure 5, which Mr. Stidd has kindly made available to the author prior to publication of his work, demonstrates these relationships quite clearly. This figure shows the field of linear correlation coefficients between over-all United States rainfall amounts for monthly periods and monthly 700-mb. height anomalies at the indicated locations. The presence of high negative correlation in the West shows that positive height anomalies in that region favor dry weather in the nation as a whole, while negative height anomalies favor wet weather. Heights in the East are also of great importance in determining nationwide precipitation as indicated by the large area of positive correlation there. These two areas of maximum positive and negative correlation taken together essentially reflect the importance of meridional wind components in determining United States precipitation, and are also related to the basic wave pattern over North America. In a paper to be published in the next issue of this *Review* Klein [5] has shown that the typical wave spacing over North America on monthly mean 700-mb. charts during the cold season calls for a trough in eastern North America when a pronounced ridge is located in the West and vice versa, as might be anticipated from vorticity considerations. In addition he has noted that either one of these patterns (i. e., trough in West and ridge in East, or ridge in West and trough in East) is more favored during the winter season than any other intermediate pattern.

Some of this October's circulation features were similar to those in existence during the summer drought [3] which was confined to southern and eastern sections of the country [3]. These were the lack of storminess over the United States, well-developed westerlies along the northern border, and the predominance of anticyclonic vorticity over the Nation. However, there were some large differences in the basic circulation type. During the summer above normal heights prevailed over the northeast Pacific and in more or less zonal fashion across the United States while heights were below normal across most of Canada. This is quite different from the meridional circulation and height anomaly patterns which were associated with this month's drought (fig. 2). These differences are probably related to seasonal variations in prevailing lengths and amplitudes of long wave patterns, strength of the westerlies, and air mass distributions.

TEMPERATURES

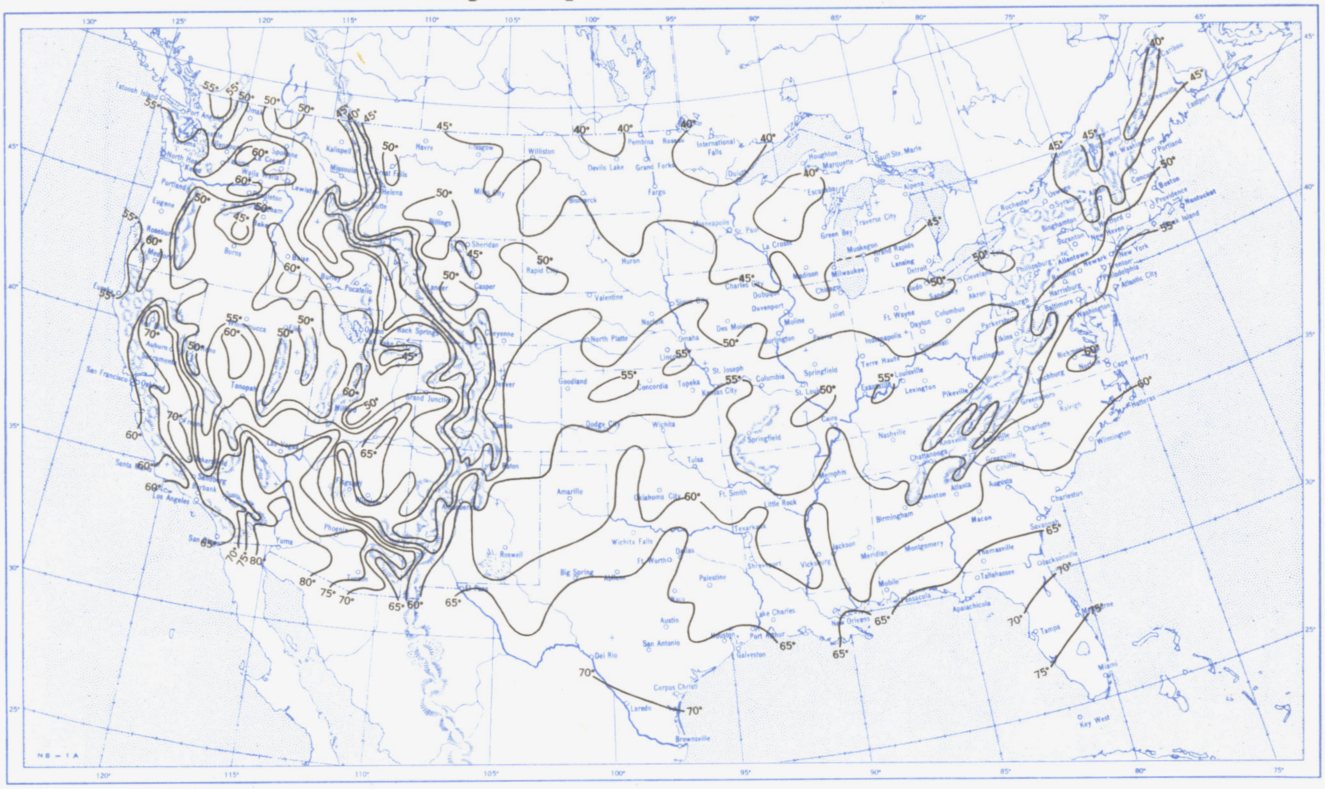
Mean temperature anomalies for October over the United States (Chart I–B) were also closely related to the month's well-defined circulation pattern (fig. 2). Under the dominance of the strongly developed ridge over the West, temperatures were above normal from the eastern slopes of the Rockies westward to the Pacific coast. Anomalies greater than +6° F. prevailed through most of the Great Basin region generally along the 700-mb. ridge line and the axis of maximum 700-mb. height anomaly from Arizona north-northwestward to Washington. At many stations in this region new record high temperatures for October were set early in the month. At Red Bluff, Calif., on the 1st and 5th the thermometer climbed to a record of 102° F., while at Yuma, Ariz., 109° F. was recorded on the 4th.

From the Great Plains eastward to the Atlantic coast this month's weather was unusually cold. This was closely related to the stronger-than-normal northerly flow between the western ridge and eastern trough which led to frequent outbreaks of cold Canadian polar air far south into most of the country east of the Rockies. The coldest weather with respect to normal occurred in the Mississippi and Ohio Valleys and the Upper Lakes, areas which were generally to the west of the mean upper level trough. As mentioned earlier the stronger-than-normal westerly flow at 700-mb. through this trough allowed the cold polar air to move to the East Coast with little chance for warm air to be advected northward at the surface. An unusually large number of cold polar highs emanated from Canada and traversed the eastern three-fourths of the United States (Chart IX) bringing new early season minimum temperature records to many stations and abnormally early frosts to the Southern States. The adjoining article by Parry and Roe presents details of record low temperatures on October 20–22.

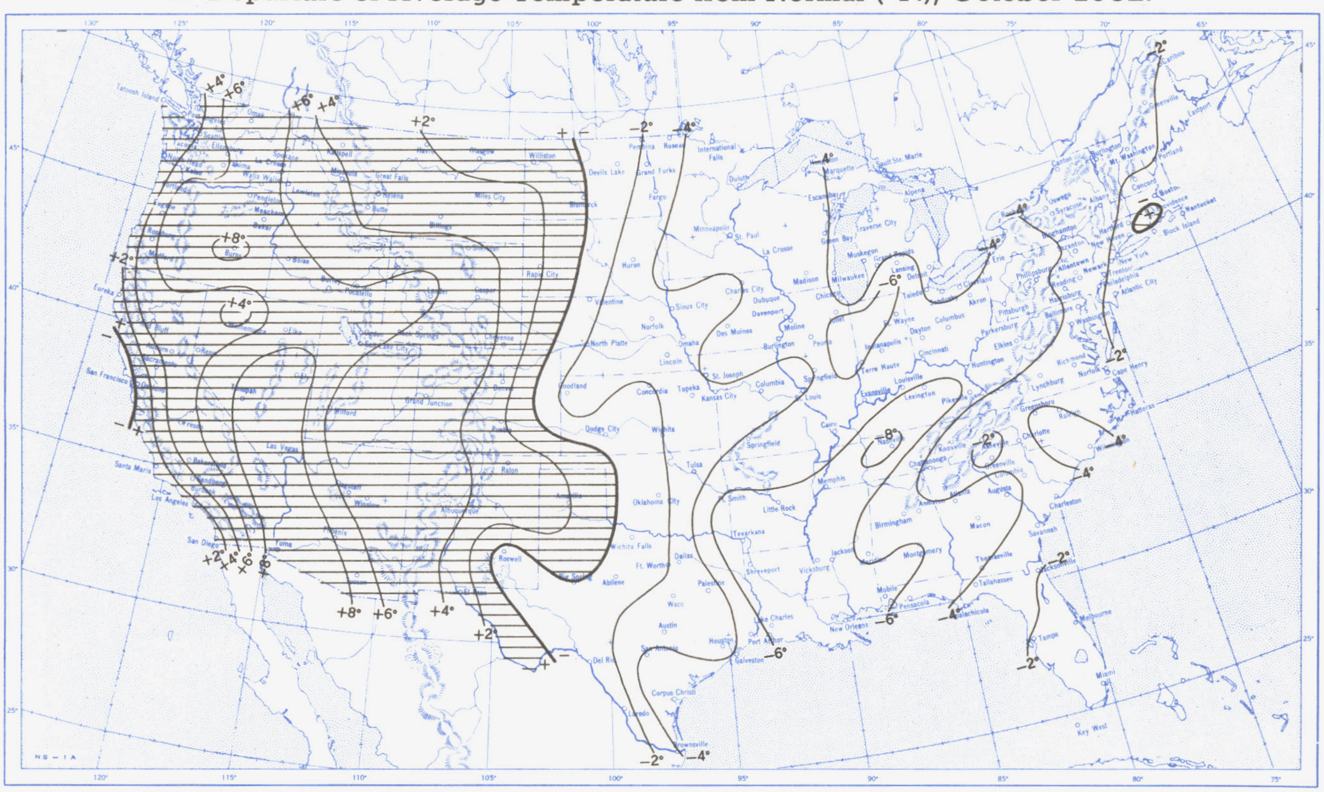
REFERENCES

1. J. S. Winston, "The Weather and Circulation of September 1952," *Monthly Weather Review*, vol. 80, No. 9, September 1952, pp. 151–155.
2. H. F. Hawkins, Jr., "The Weather and Circulation of August 1952," *Monthly Weather Review*, vol. 80, No. 8, August 1952, pp. 134–137.
3. W. H. Klein, "The Early Summer Drought of 1952," *Weatherwise*, vol. 5, No. 5, October 1952, pp. 111–113.
4. I. R. Tannehill, *Drought, its Causes and Effects*, Princeton University Press, Princeton, N. J., 1947, 264 pp.
5. W. H. Klein, "Some Empirical Characteristics of Long Waves on Monthly Mean Charts," to be published in *Monthly Weather Review*, vol. 80, No. 11, November 1952.

Chart I. A. Average Temperature (°F.) at Surface, October 1952.

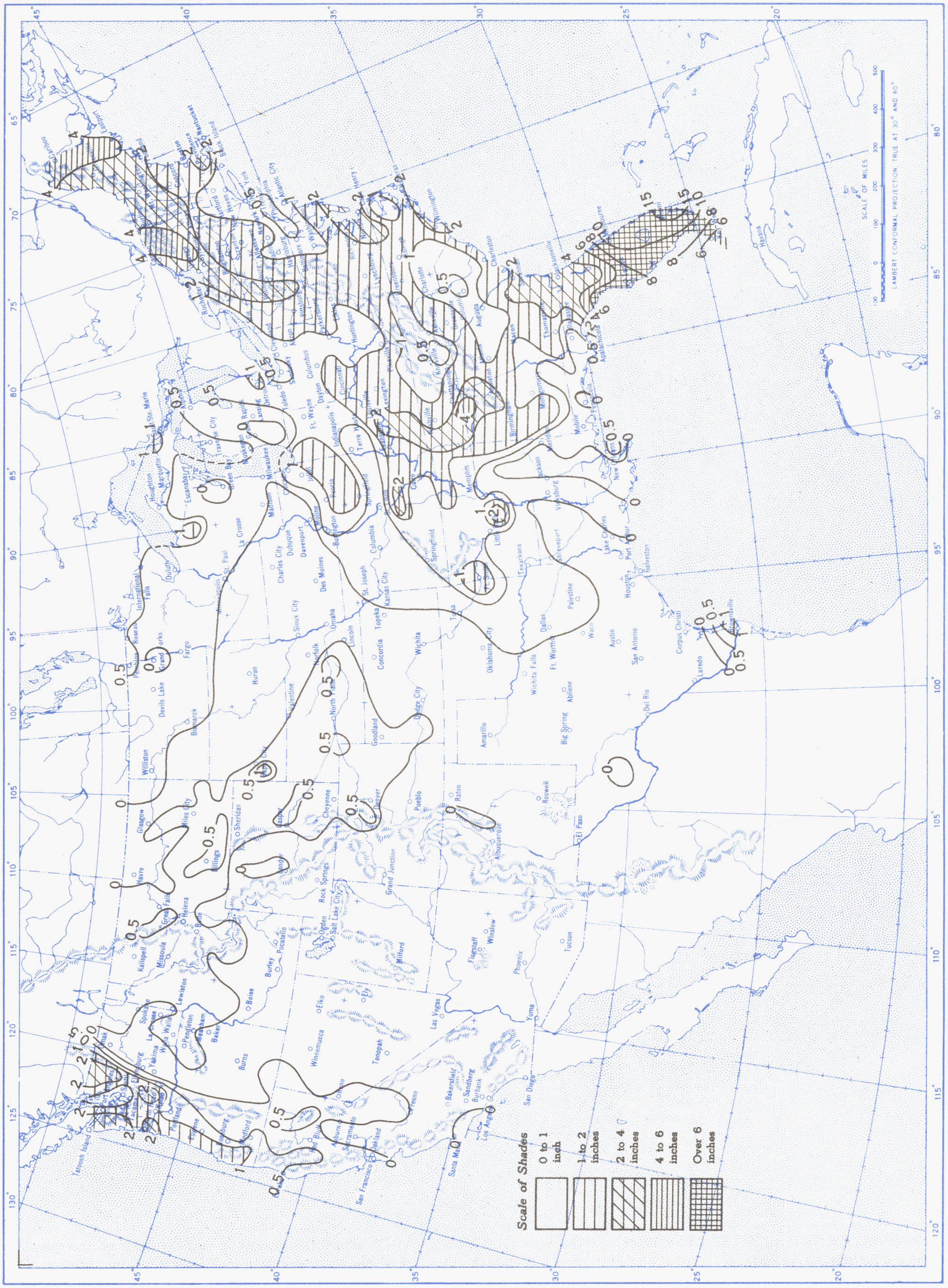


B. Departure of Average Temperature from Normal (°F.), October 1952.



A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

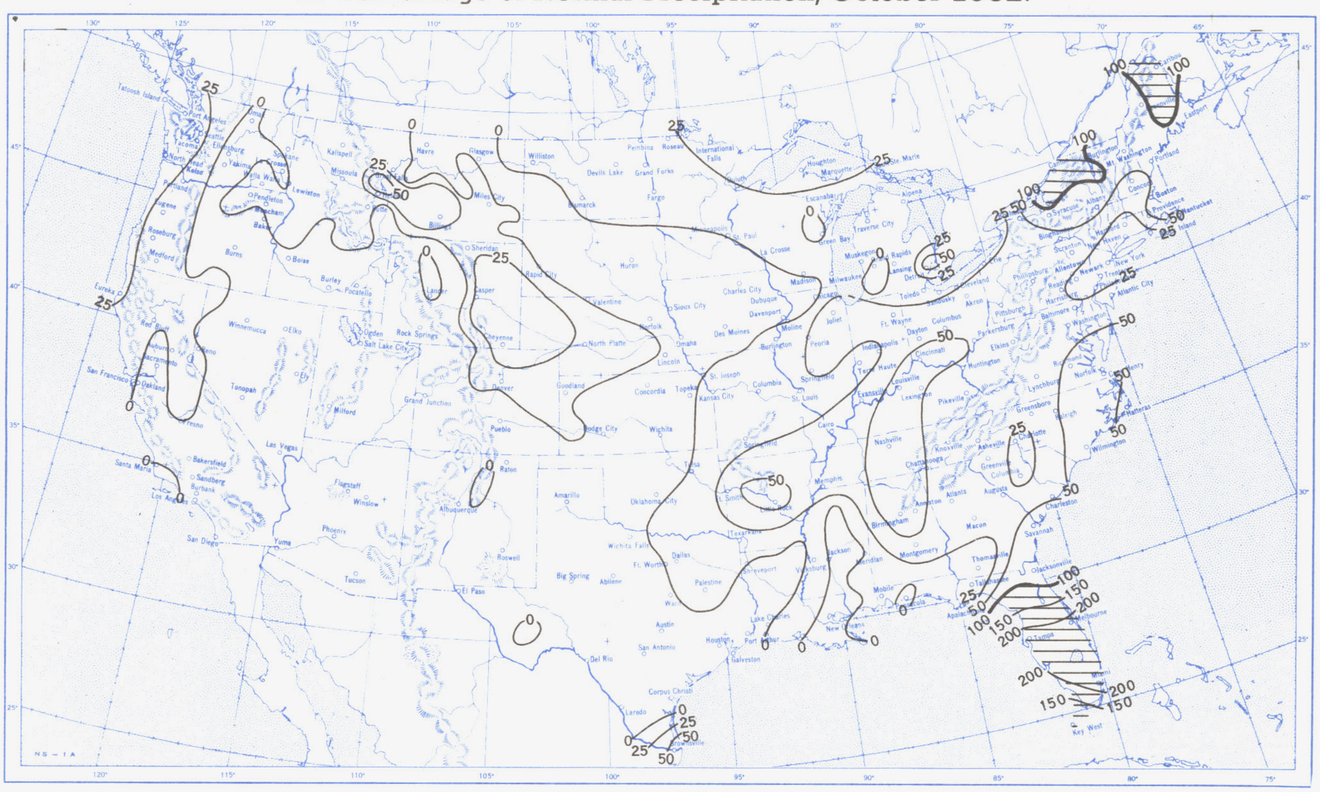
Chart II. Total Precipitation (Inches), October 1952.



Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

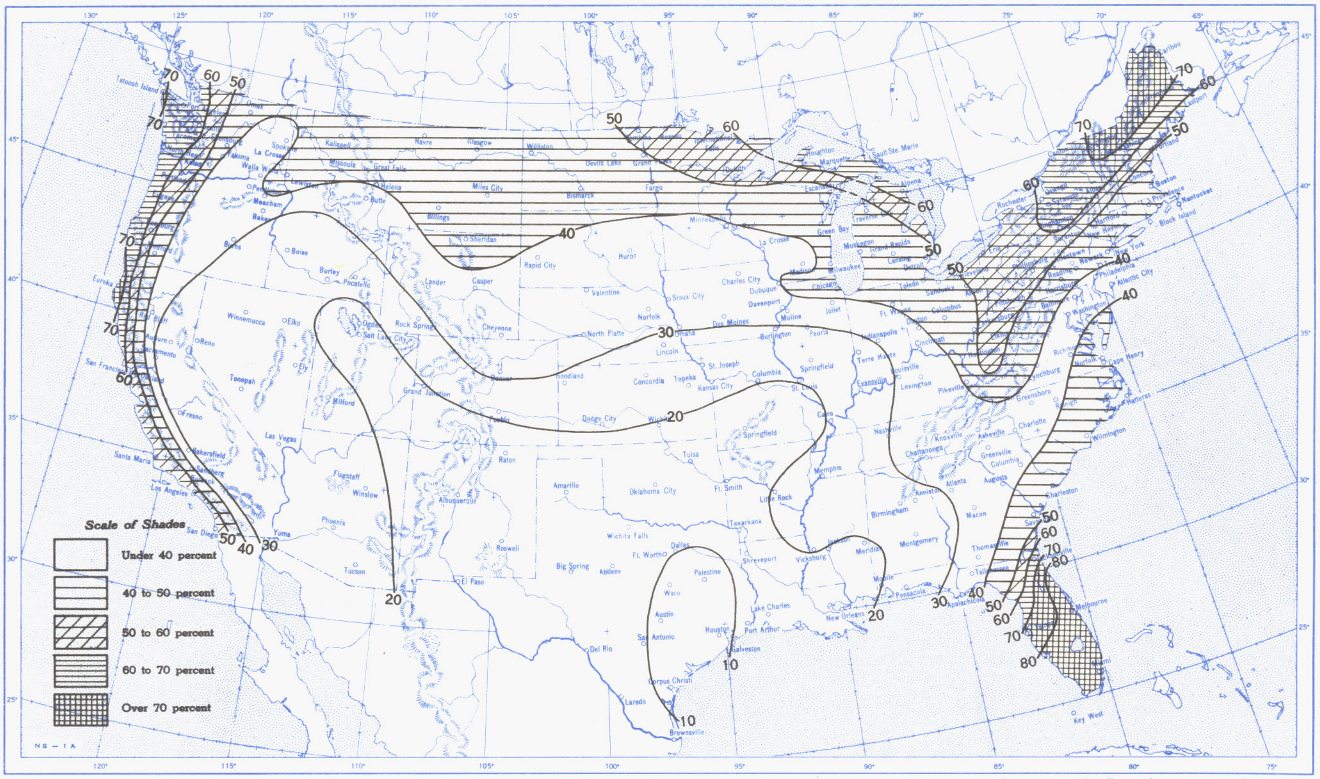
Chart III. A. Departure of Precipitation from Normal (Inches), October 1952.

B. Percentage of Normal Precipitation, October 1952.

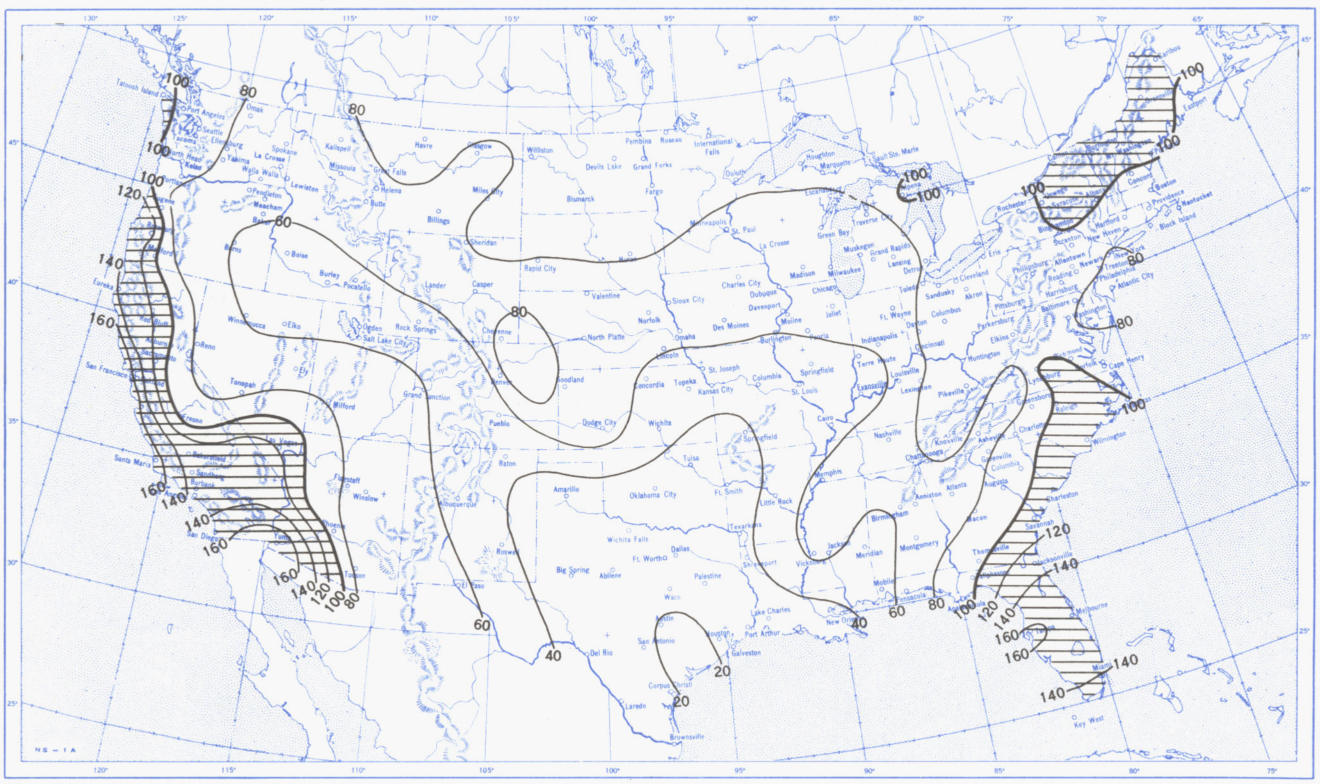


Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, October 1952.

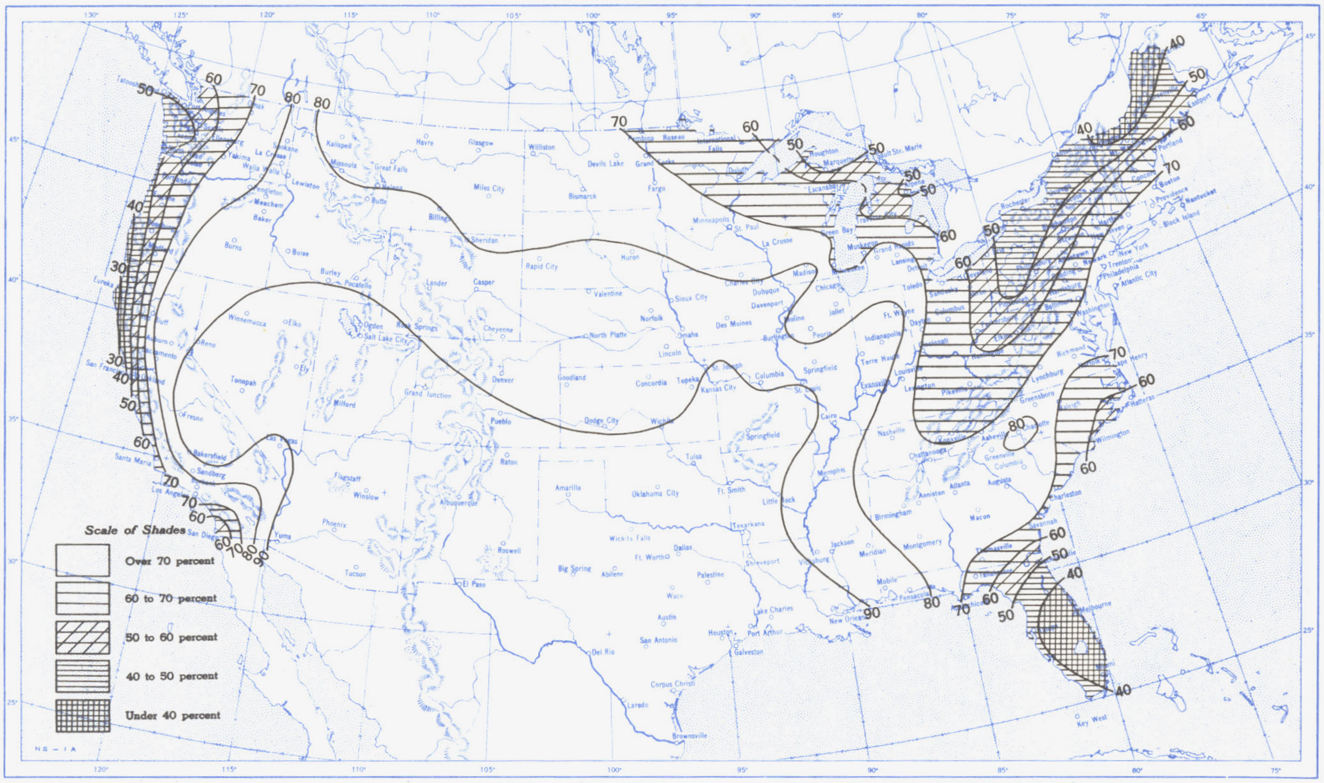


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, October 1952.

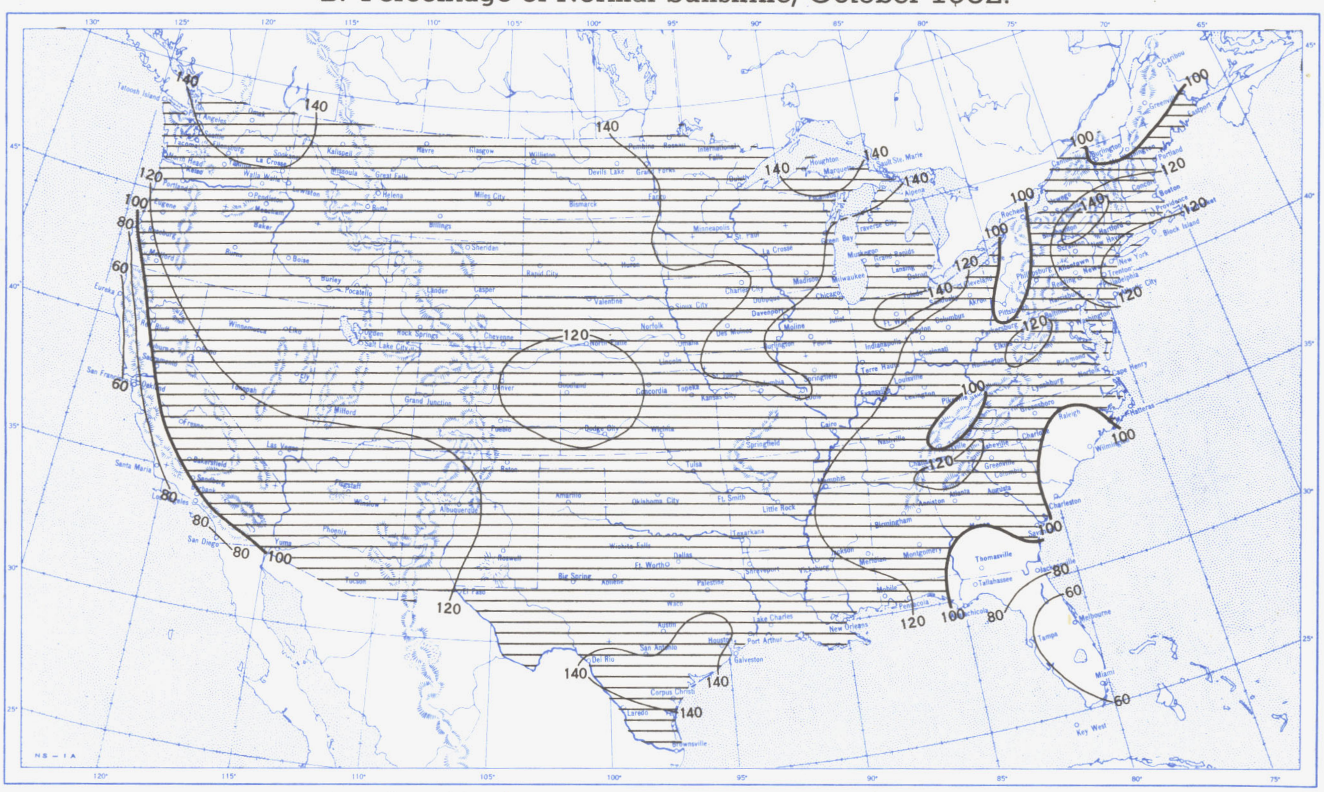


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, October 1952.



B. Percentage of Normal Sunshine, October 1952.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, October 1952. Inset: Percentage of Normal Average Daily Solar Radiation, October 1952.

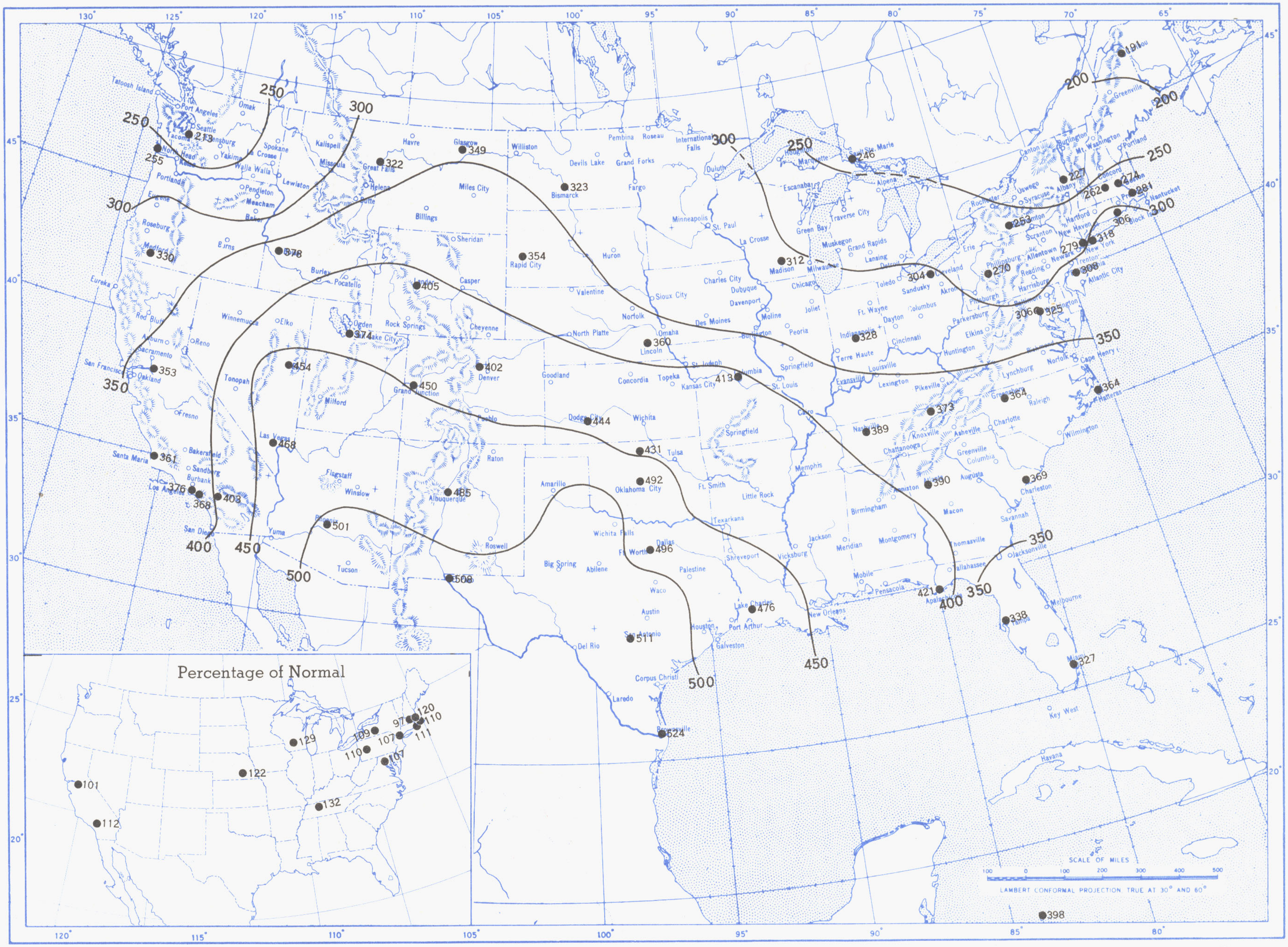
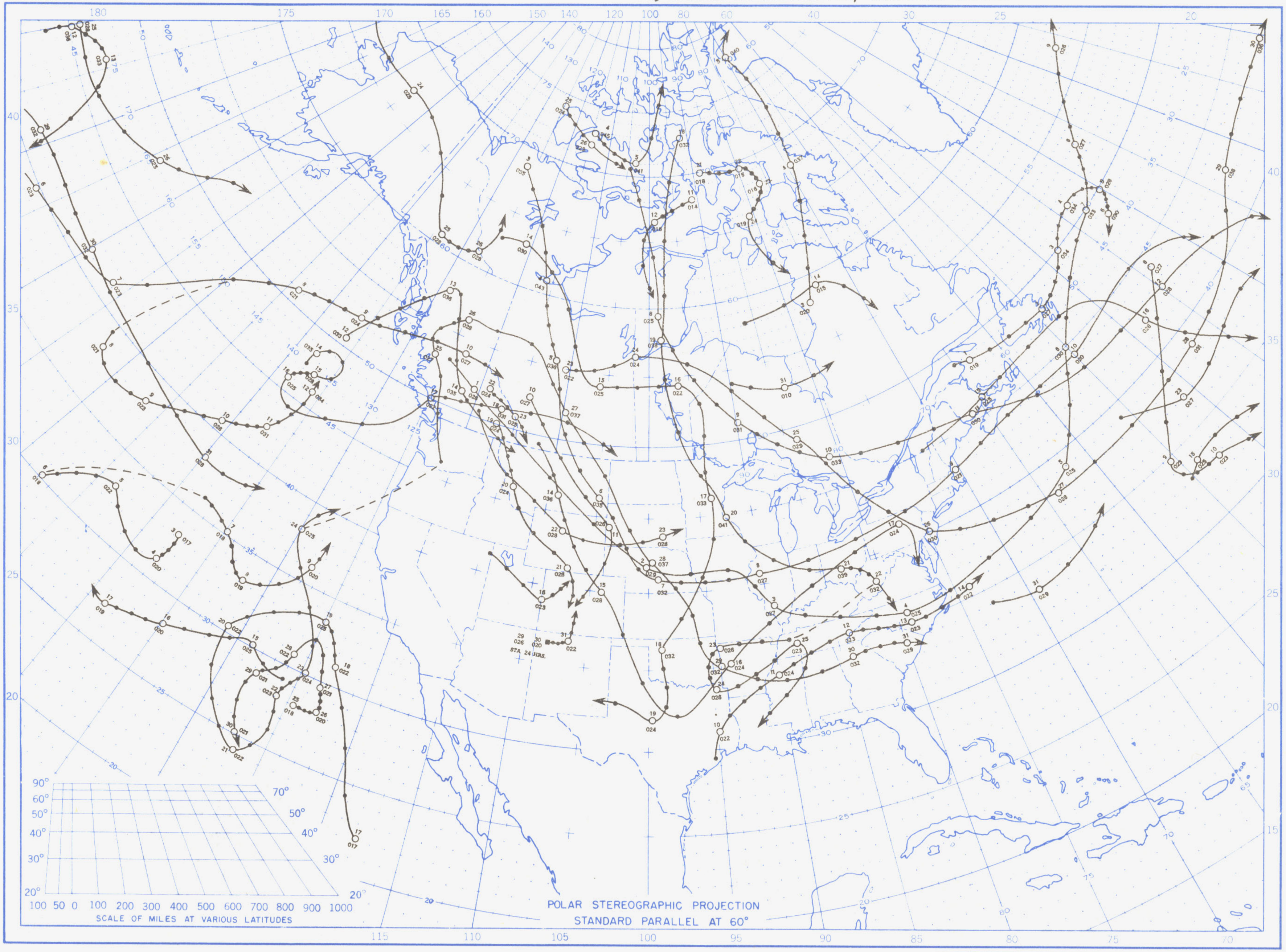


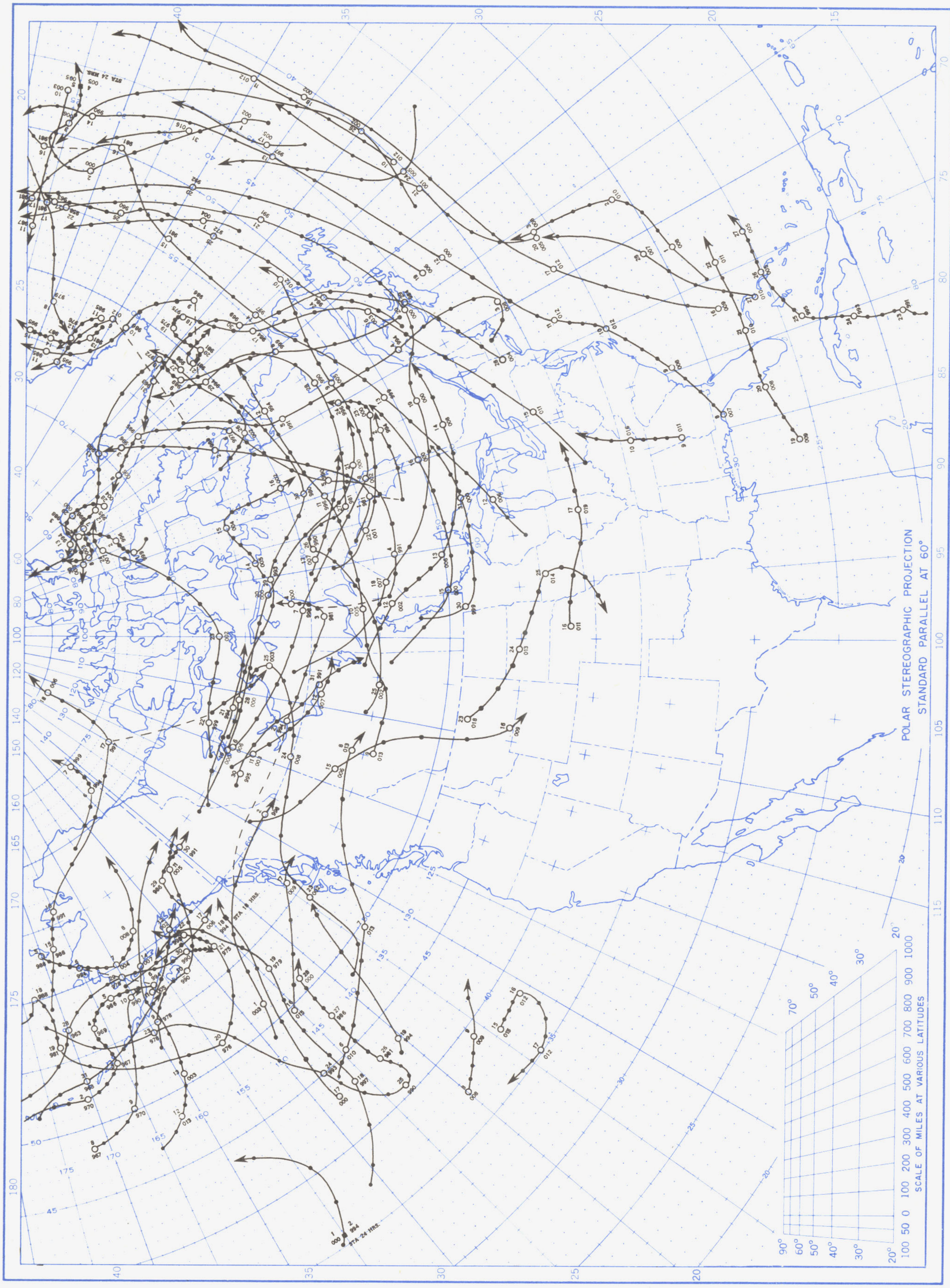
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm.$^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. Normals are computed for stations having at least 9 years of record.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, October 1952.



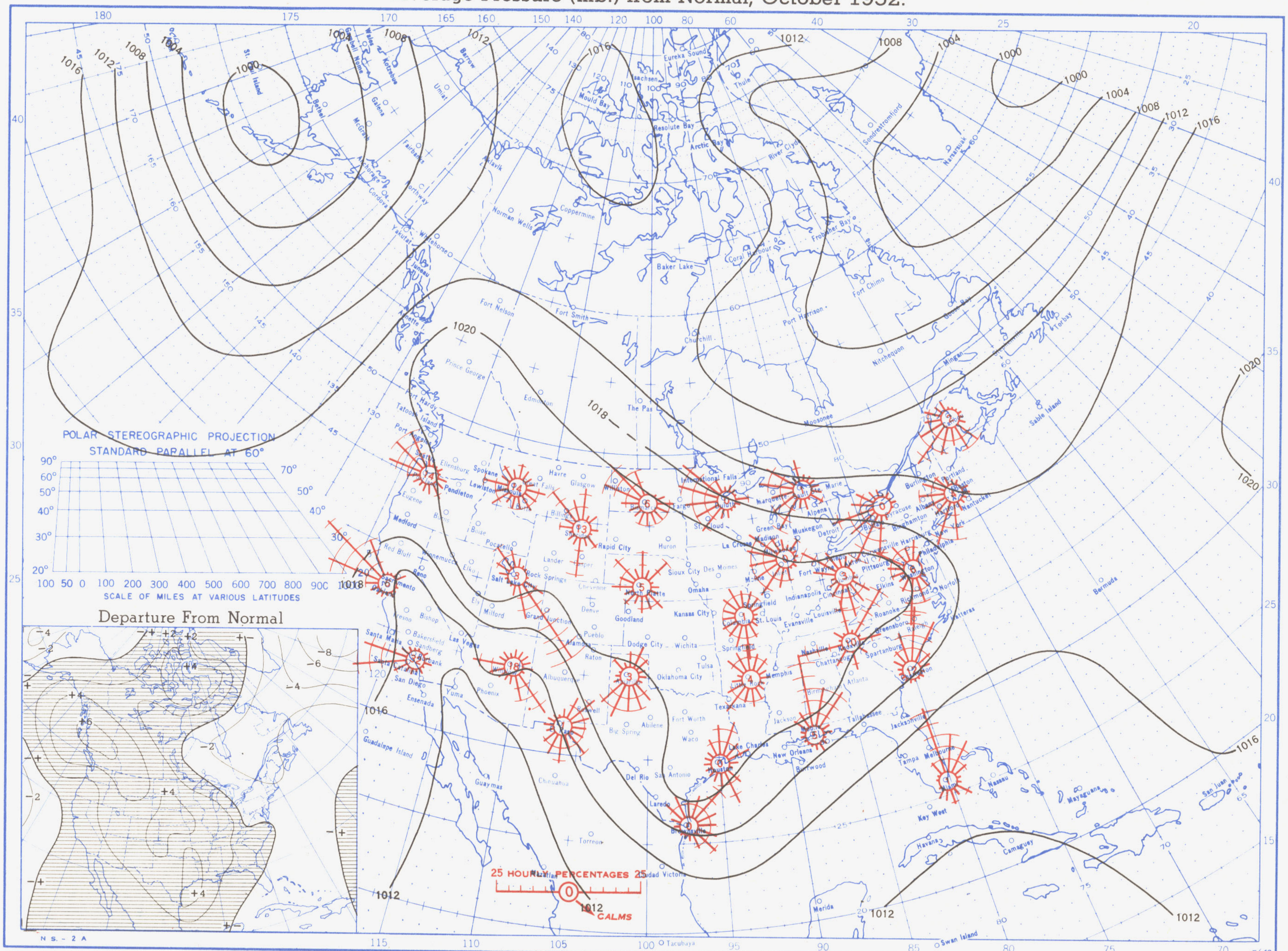
Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, October 1952.



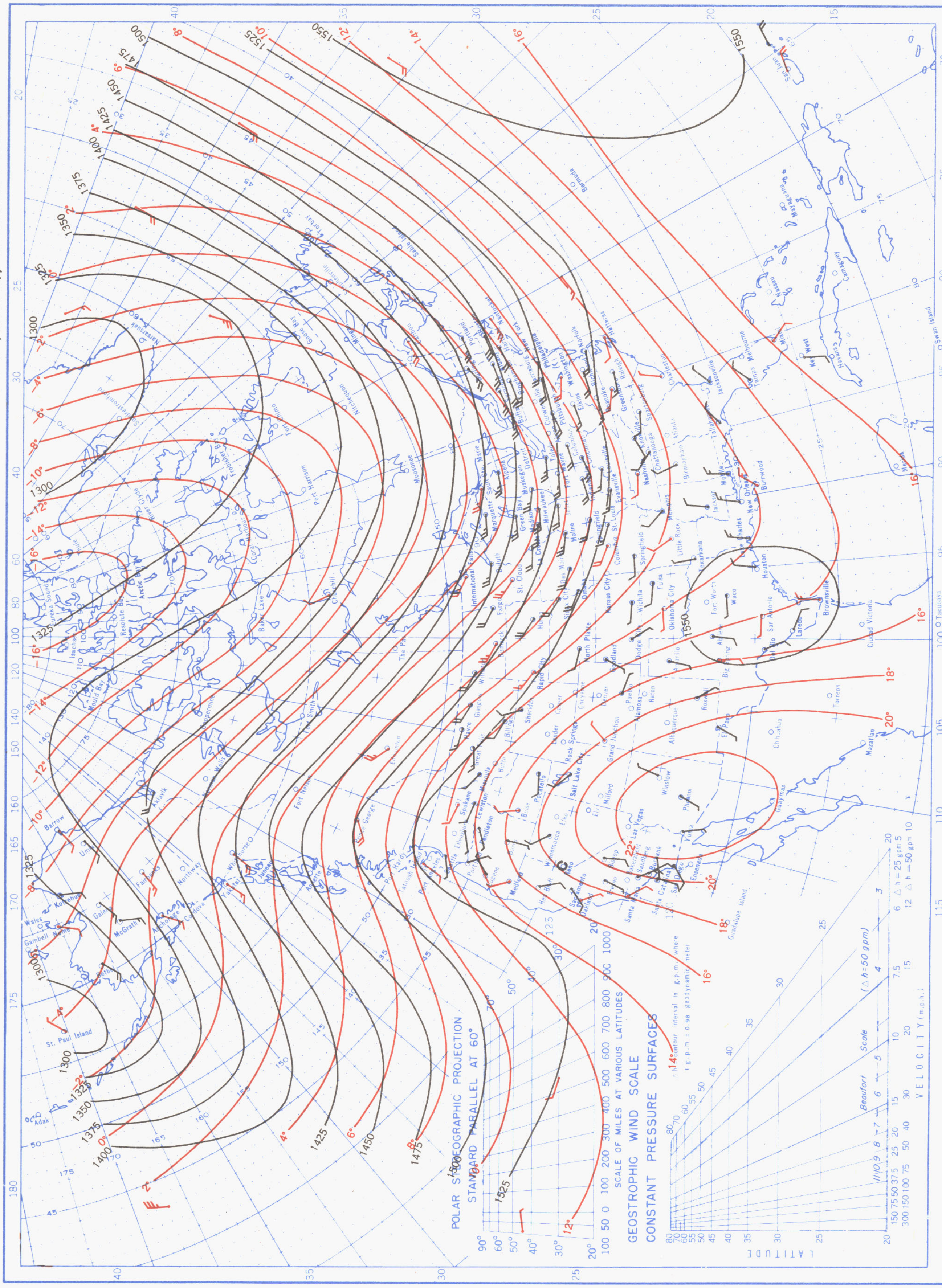
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, October 1952. Inset: Departure of Average Pressure (mb.) from Normal, October 1952.



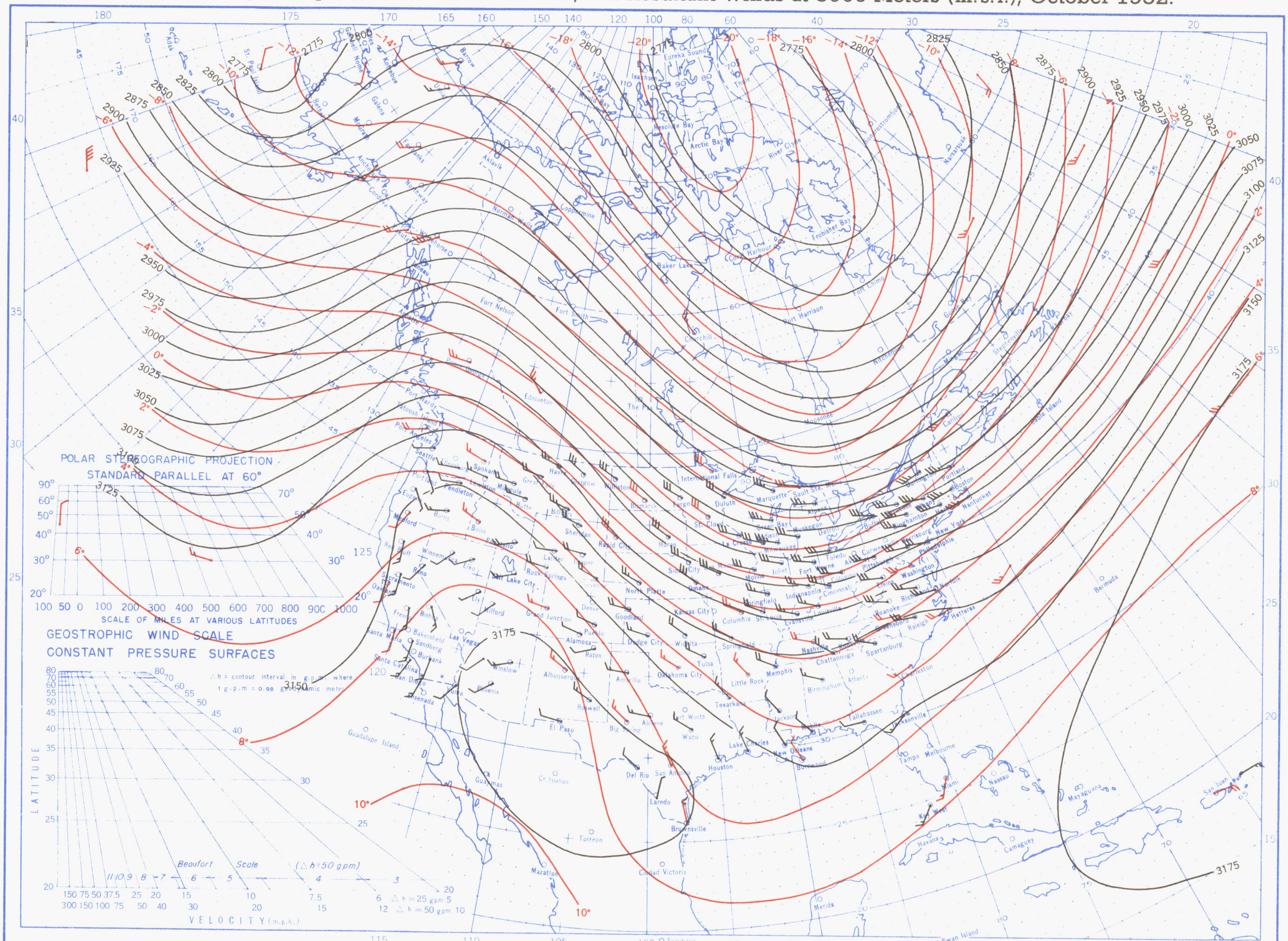
Average sea level pressures are obtained from the averages of the 7:30 a.m. and 7:30 p.m. E.S.T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), October 1952.



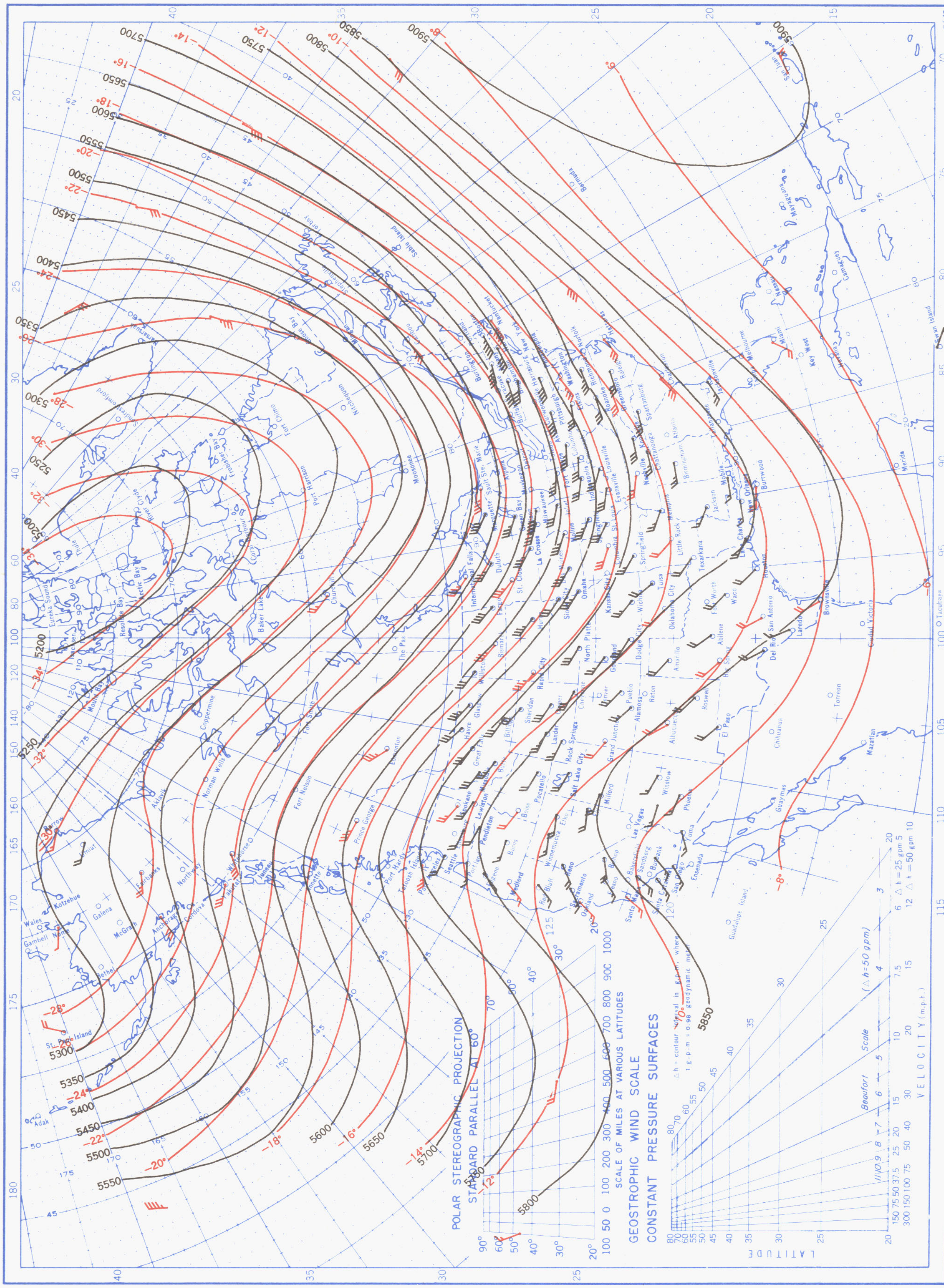
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m.. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), October 1952.



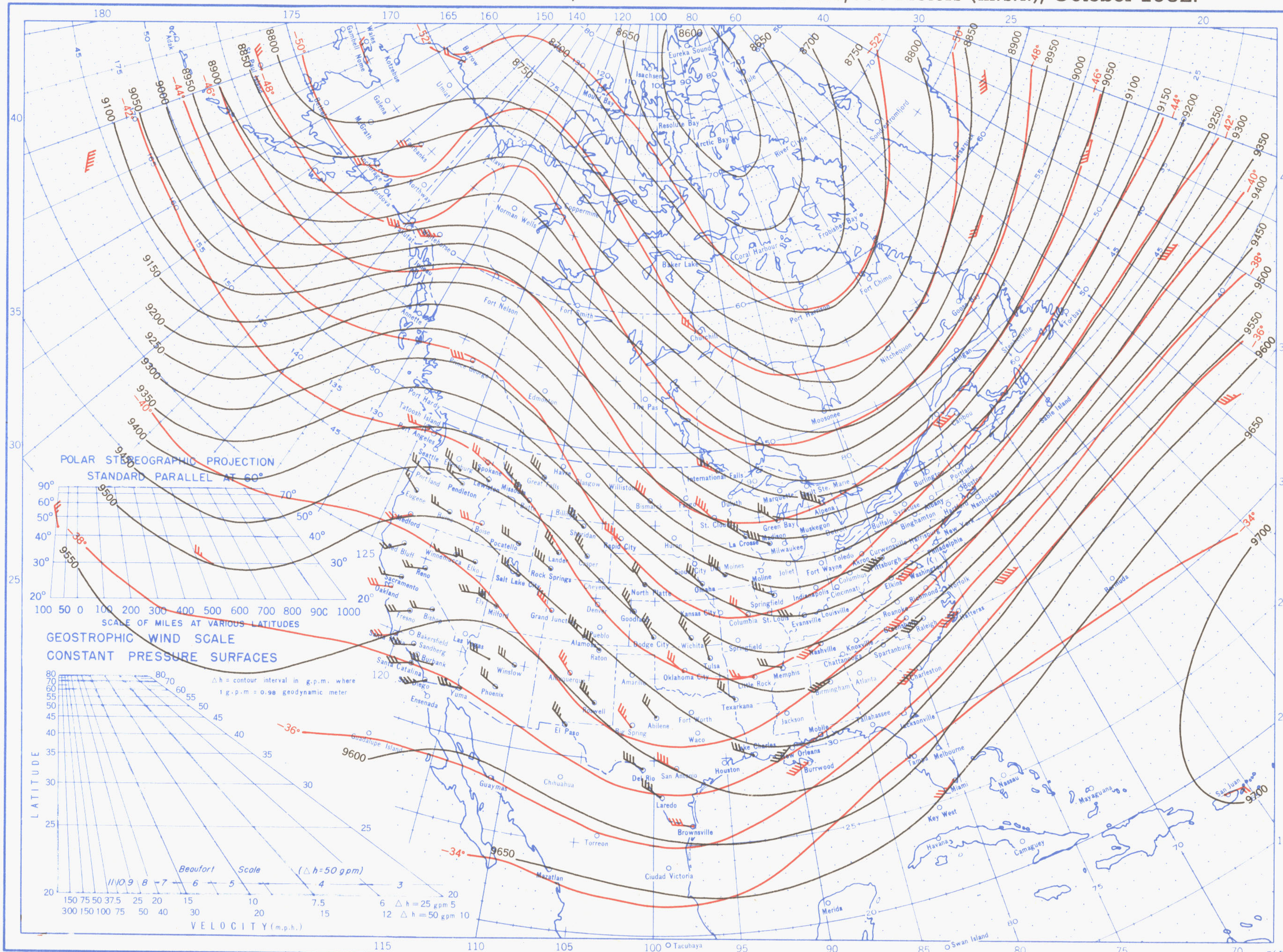
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T.

Chart XIV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m.s.l.), October 1952.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), October 1952.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T.